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Sewage Contamination of Belt Creek

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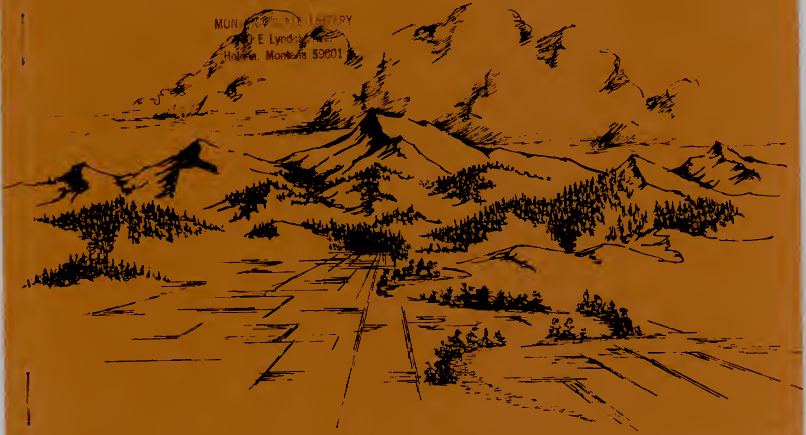
by

Pat Goodover



Resources Development Internship Program
Western Interstate Commission for Higher Education

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A STUDY OF
SEWAGE CONTAMINATION OF BELT CREEK
ABOVE BELT, MONTANA

PAT M. GOODOVER II, INTERN

IN CONJUNCTION WITH
THE CASCADE COUNTY HEALTH DEPARTMENT
AND SUPERVISED BY

Don Zollman
Donald E. Pizzini
Jon Tovson
Robert K. Stevenson

September 1973

TABLE OF CONTENTS

ABSTRACT Page 1

INTRODUCTION Page 2

MATERIALS & METHODS Pages 3 and 4

RESULTS Pages 5 and 6

DISCUSSION Pages 7 and 8

RECOMMENDATIONS Page 9

TABLES Pages 10 and 11

GUIDE TO MAPS Page 12

MAPS

ACKNOWLEDGEMENTS Page 13

LITERATURE CITED Page 14

ABSTRACT

This study was undertaken to determine the nature of sewage disposal facilities of land owners along Belt Creek above Belt, Montana; to locate any discharge pipes in or near the creek; and to recommend changes in undesirable sewage disposal facilities. All buildings within 200 feet of Belt Creek were checked, and problems identified were referred for corrective action to the State Department of Health and Environmental Sciences. Total and fecal coliform densities at various locations along Belt Creek were determined to indicate whether or not water degradation was occurring.

A total of twelve direct sewage discharges and six dishwater discharges into Belt Creek were found. There were eight old unused sewage discharge pipes leading to the creek, and 26 outhouses within 50 feet of Belt Creek.

The coliform results indicated no permanent degradation of Belt Creek, but rather a temporary degradation of the water as Belt Creek passed through Neihart and as Otter Creek emptied into it.

All tributaries of Belt Creek were found to be relatively free from sewage contamination, except for Otter Creek, which entersBelt Creek above Armington. The coliform test stations on Otter Creek showed a high fecal coliform count, indicating the presence of sources of sewage contamination.

The number of discharges found and the degree of water degradation was less than expected prior to the conduct of the study.

INTRODUCTION

Belt Creek is a popular recreational waterway in Cascade County, Montana. During the summer months it is used by the public for fishing, floating, and swimming, in addition to being used by summer home owners. In the winter the surrounding area is used by ski and snowmobile enthusiasts. Belt Creek is undoubtedly the most scenic watershed in Cascade County, and its visual attraction is a significant type of public use.

There are three communities lying on the creek within the study area. Just above Belt is the community of Armington; twenty miles further upstream is Monarch; and twelve miles further is Neihart. All communities have a permanent population of less than 100 people, but grow to over this amount on the weekends and holidays due to summer home owners and tourist traffic.

For many years Cascade County residents have complained of sewage discharge pipes jutting into the creek. This study was undertaken to locate, and precisely identify, these sewage discharges plus any other discharges (dishwater) and to verify sewage disposal facilities on all property within 200 feet of Belt Creek and its tributaries. Where problems were identified, referrals for corrective action were made to the State Department of Health and Environmental Sciences.

MATERIALS & METHODS

PUBLICITY

A letter was sent to most of the landowners in the Monarch-Neihart area explaining the purpose of the study, and stating that if they weren't at their property when the study was conducted, they would be contacted, and a mutually suitable meeting time would be arranged. Other landowners in the study area were not formally contacted, however a letter of introduction and authorization was prepared for presentation to these landowners.

News releases were sent out periodically to the local newspaper and radio stations to inform the public of our progress. In addition, a local television station filmed a documentary feature, which included some data gathered from this study.

DYE TEST

If indoor plumbing existed, fluorescein dye was used to test the sewage treatment effectiveness. This dye, a red powder which turns bright fluorescent green in water, was expected to be filtered out in soil in the same distance as would micro-organisms. Therefore, its appearance in the creek was used as an indicator of non-effective treatment of sewage. An arbitrary time length of thirty (30) minutes was used as the time limit for appearance in the stream. Questionable systems were rechecked at from several hours to days after introduction of the dye to verify the effectiveness of the system. The fluorescein dye was prepared by Hach Chemical Company, Ames, Iowa.

WATER QUALITY ANALYSIS

Samples for total and fecal coliform tests were obtained at various locations and times along the creek. (See maps). The first group of samples was taken on Tuesday and Wednesday, to determine a mid-week water quality picture, and were processed at the State Water Laboratory in Helena, Montana. The second group was taken on a Sunday morning, and were processed by the author at the Montana State University Microbiology Department laboratory, following the 13th Edition of Standard Methods for the Examination of Water and Wastewater, 1971. The media used was M-ENDO medium for total coliform, and M-FC medium for fecal coliform.

The tests were performed by the membrane filter technique, as outlined in Standard Methods. Varying dilutions were used, depending on the source of the water sample and probable level of contamination of the water at that location. The samples were incubated in an air incubator at 35°C. for total coliforms, and in a recirculating water bath at 44.5°C. for fecal coliforms.

The organisms were counted with a colony counter. For total coliforms, all colonies which produced a green metallic sheen were counted. It should be noted that, according to Standard Methods (p.681), "The coliform group thus defined is not necessarily the same as the group defined as the 'Coliform group' and described in the multiple-tube fermentation technique, but it probably has the same sanitary significance." (1) Fecal coliform colony counts were obtained by counting all colonies which produced a blue color. The coliform density for each was computed with the formula: Coliform colonies/100 ml = (# coliform colonies x 100) / (ml of sample filtered.)

The State Department of Health and Environmental Sciences also conducted their own studies on the conductivity and pH of Belt Creek at various locations along the creek. Their findings were not included in this report, since conductivity and pH readings of Belt Creek were not significantly affected by sewage contamination.

VISUAL CHECK OF GROUNDS

A visual check at every location was conducted, and any exposed pipes and their purpose were noted. The location and type of any privy (outhouse) was also noted.

RESULTS

DYE TEST

The dye was not detected in the stream when used to test any existing septic tank-soil absorption system, regardless of the distance to the creek. The dye appeared only when there was a direct sewage discharge. (See Table 1 and maps for location of discharges.) The dye test revealed discharges from one hotel, four summer residences, and seven permanent residences. The discharge above Monarch was from a cabin, situated amidst a group of summer homes. (See maps.) The discharge at location NA 106x18 (refer to "Guide to Maps" for an explanation of map coordinate coding) was from a hotel. The discharges from locations NA 115x23, NC 108x16, and NC 108x17 were all from summer homes and the remaining discharges came from permanent residences.

Discussions with the owner of the home at location NA 112x21 revealed that a sewage discharge pipe reportedly drains from location NZ 110x23, and empties into Belt Creek just above the lower bridge in Neihart. This report was not verified, as no contact could be made with the owner. There was however, a pipe which enters Belt Creek at that location,and it appeared to come from the direction of the house at location NA 110x23.

WATER QUALITY ANALYSIS

The results of the coliform tests have been listed in Table 2. During the week, Belt Creek entered Neihart with excellent bacteriological quality. (2) As it passed through Neihart, the water gained some contamination, but this was mainly non-fecal. As the creek proceeded to Monarch, it continued to increase in total coliform density, but not significantly in fecal coliform density.

After Belt Creek passed Monarch, the coliform density declined until it reached Armington Junction, above Armington, where Otter Creek entered Belt Creek. The coliform counts from Otter Creek around Raynesford, a small community outside Cascade County, were extremely high as compared to the coliform counts from Belt Creek. As a result, Belt Creek at Armington, (about one mile downstream from where Otter Creek entered Belt Creek) showed an increase in the coliform densities.

On the weekend, Belt Creek still entered Neihart in an extremely clean condition. As it passed through Neihart, the water gained considerably in fecal coliforms so that when Belt Creek left Neihart, the water was quite contaminated. By the time Belt Creek reached Monarch, it had lost most of its fecal contamination. Above Armington, Otter Creek entered Belt Creek with a fecal coliform density near that which Belt Creek had as it left Neihart. Again, the coliform density of Belt Creek at Armington increased slightly. All of the tributaries of Belt Creek, except for Otter Creek, appeared to be relatively free from sewage contamination, as indicated by the lack of fecal coliforms. Otter Creek was very contaminated.

VISUAL CHECK

The visual check revealed 59 pipes leading to the creek, of which six were for the discharge of dishwater, twelve were for the discharge of sewage, and eight were old sewage discharge lines which are no longer in use. The rest of the pipes were irrigation pipes, and were not considered to be significant to this study. (See Tables 1 and 3).

The dishwater discharge pipes were mainly in Neihart. Four were in Neihart, and one in Monarch, and one above Monarch. Only one of these was from a permanent residence (NB 122 x 19). All of the others drained from summer homes.

All of the old unused sewage discharge pipes were at locations which currently have a septic tank, or use an outdoor privy. One is in Monarch, two are above Monarch, four are in Neihart, and one is above Neihart.

There were also 26 outhouses within 50 feet of the creek. Most of these were in the Monarch area (See Table 4). In one instance, the outhouse was directly over a spring-fed stream, which lead to Belt Creek (location M+1, 113 x 34).

DISCUSSION

DYE TEST

Since the dye did not appear when used to test existing septic tank-absorption systems, it was concluded that the sewage in these cases received adequate bacterial treatment. This belief was based on the premise that the dye would not appear in the stream if there was enough bacterial filtration from the soil. If this premise was valid, then the sewage should have received adequate bacterial filtration. This in no way meant that the nutrients from the sewage effluent were being filtered out, and it was considered likely that nutrients were entering Belt Creek, especially when the septic system drainage field was less than 50 feet from the creek. Equipment to test for this, however, was not available. The arbitrary 30 minute time period for appearance of the dye may not have been sufficient, but in some instances the systems were observed for several hours with no change in results.

The sewage discharges found represented an obvious health hazard to anyone using Belt Creek. All were in areas frequented by children and others.

In most instances no attempt was made to change from the sewage discharge systems in use to a septic tank system, or any other system. This was not because the owners did not know about the discharges; it was because they were of the opinion that they would change when told to do so, and not before. Only two landowners did not know that they were discharging directly into the creek.

WATER QUALITY ANALYSIS

The rise in the fecal coliform density of Belt Creek as it passed through Neihart during the week was probably due to the direct sewage discharges, since any fecal coliform level at all indicates some source of sewage contamination. However, the level was rather low. It appears that Belt Creek filtered itself as it traveled downstream, so that by the time it reached Monarch, it was fairly clean. The fecal coliform density at Monarch was the largest mid-week value, but it was still low, and within the limits of experimental error.

On the weekend, Belt Creek gained more fecal coliforms than during the week as it passed through Neihart, and the creek left Neihart with the highest level of fecal coliform contamination that it ever had. This was probably due to the increased use of the residences which had direct discharges. Belt Creek filtered itself well enough so that by the time it reached Monarch, the water was relatively free from fecal coliforms.

Since the water in Belt Creek eventually cleaned itself up, it was hard to show any permanent degradation of Belt Creek by the sewage discharges, but it was shown that there was a temporary degradation of Belt Creek as it passed through Neihart.

All of the major tributaries of Belt Creek, with the exception of Otter Creek, appeared to be free from any sewage contaimination. The increase in the coliform density at Armington was probably due entirely to the influence of Otter Creek on Belt Creek. It was concluded that the only tributary with an adverse effect on water quality of Belt Creek was Otter Creek.

There was a spring in Neihart, at location NB 120 x 17, which showed a significant fecal coliform density, as compared to the side stream it emptied into. There was an irrigation pipe leading to a pump, which was beside the spring, and no other apparent pipes lead to it. The owner at location NB 121 x 17 could not be located. All of the other owners in the area had septic tanks. The spring may have drained a septic drain field, or there may have been a discharge from location NB 121 x 17.

VISUAL CHECK

The dishwater discharges into Belt Creek were not directly related to sewage problems, but they may have added phosphates and minerals which, in large amounts, could probably have been shown to be detrimental to the stream. The soap suds also detracted from the visual appearance of Belt Creek.

It was impossible, to show any adverse affect the outhouses had upon the creek, but it was considered probable that a few added some contamination, especially if the outhouse was within ten feet of the creek. In the case where the outhouse was directly over the side stream, it was considered a direct discharge, and was recommended to be delt with accordingly.

RECOMMENDATIONS

At the request of the Cascade County Health Department, I will leave any detailed recommendations to them. Since the study did indicate a degradation of the water, although temporary, owners with discharge pipes should be required by the State Department of Health and Environmental Sciences to remove them. I also recommend that a study similar to this one be conducted in the Raynesford area, since this area is a probable source of sewage contamination ob Belt Creek.

TABLE 1

DISCHARGE LOCATIONS			
LOCATION	TYPE	LOCATION	TYPE
M 115x10.5	Dishwater	NB 122x19	Dishwater
M+1, 109x15	Dishwater	NB 123x14	Dishwater
M+1, 110x15.5	Sewage	NC 104x4	Dishwater
NA 106x18	Sewage	NC 105x14	Sewage
NA 112x21	Sewage	NC 108x16	Sewage
NA 114x20	Sewage	NC 108x17	Sewage
NA 115x23	Sewage	NC 108x19	Sewage
NA 116x26	Sewage	NC 108x23	Sewage
NB 120x4	Sewage	NC 114x30	Dishwater

TABLE 2

COLIFORM DENSITY				
LOCATION NUMBER	Total Coliform		Fecal Coliform	
	GP 1	GP 2	GP 1	GP 2
1	3	-	1	-
2	7	17	1	0
3	1	10	1	0
4	23	51	3	10
5	25	150	4	62
6	62	-	11	-
7	28	-	5	-
8	24	60	11	13
9	58	57	15	10
10	26	35	9	3
11	14	80	12	36
12	514	-	300	-
13	-	310	-	65
14	55	-	32	-

NOTE: a dash (-) indicates that no test sample was taken for that group.

TABLE 3

LIST OF OLD DISCHARGE PIPES	
LOCATION	LOCATION
M 115x12	NB 116x2
M+1, 107x11	NC 108x20
M+3, 118x19	NC 108x21
NA 105x16	N+1, 105x1

TABLE 4

OUTHOUSES NEAR BELT CREEK			
LOCATION	DISTANCE TO CREEK	LOCATION	DISTANCE TO CREEK
M 115x7	15 Ft	M+1 108x12	15 Ft
M 115x8	20 Ft	M+1 108x14	5 Ft
M 115x10.5	20 Ft	M+1 109x15	10 Ft
M 115x12	20 Ft	M+1 109x15.5	10 Ft
M 115x13	30 Ft	M+1 110x16.5	30 Ft
M 115x17.5	10 Ft	M+1 111x19	30 Ft
M 115x19	7 Ft	M+1 112x21	30 Ft
M 115x22	15 Ft	M+1 113x34	0 Ft
M 115x24.5	10 Ft	M+2 107x17	15 Ft
M 114x26	20 Ft	M+3 118x26	15 Ft
M 113x28	20 Ft	M+4 112x28	30 Ft
M+1 103x4.5	10 Ft	M+4 109x33	20 Ft
M+1 106x8	10 Ft	NA 113x12	20 Ft

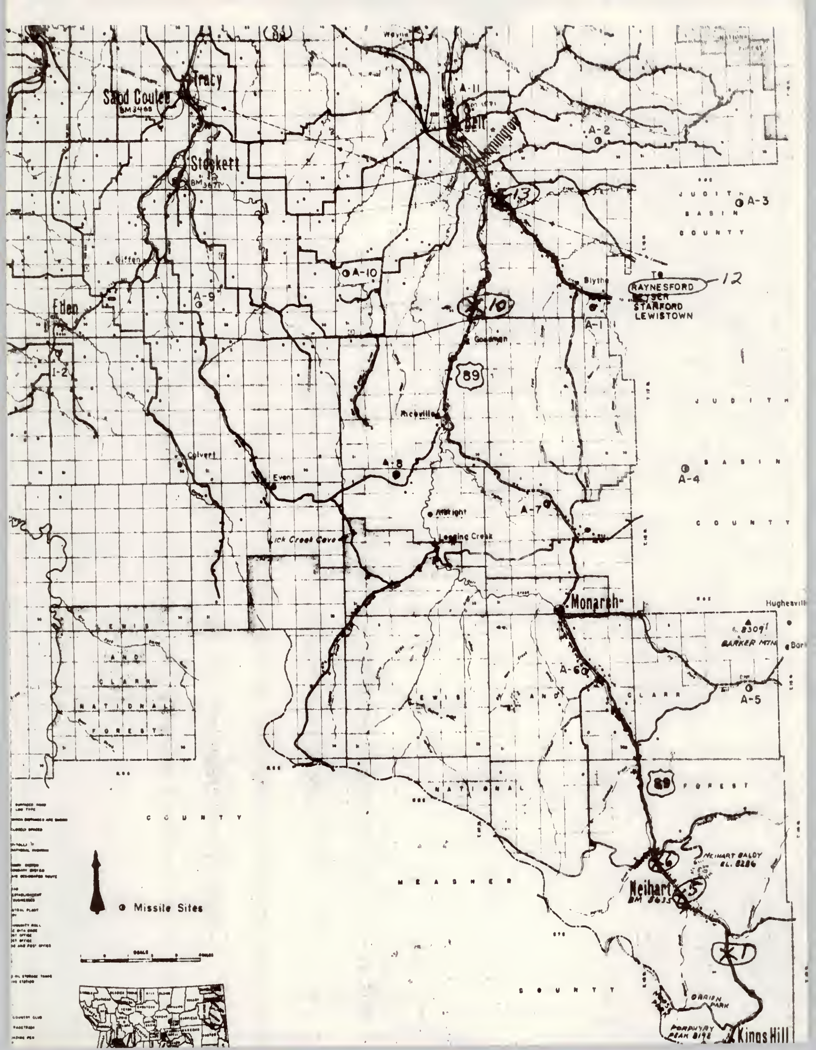
GUIDE TO MAPS

The following maps are in sequence, starting with the map of Armington and ending with the map of the area above Neihart. A County map preceeds the other maps, and is intended to show the overall area from Armington to King's Hill, above Neihart.

Except for the maps of the three communities, the maps are labelled according to where the area on the map is in relation to Monarch or Neihart. For example, Monarch + 3 means that the area shown on the map is in the third section above Monarch. When referred to in the text, abbreviations are used for the map sections. For example, Monarch + 3 is abbreviated M+3.

Neihart is broken up into three sections-sections A, B, and C. Abbreviations for them are NA, NB, and NC.

The numerical guides along the edges are completely arbitrary. A solid square on the map (■) represents a location which has a direct sewage discharge into Belt Creek. A checked square (☒)represents a location with a dishwater discharge to the creek. The box with lines in only one direction (▨) represents the suspected, but not confirmed, sewage discharge. An "X" represents an area at which a water sample was taken, and the number beside the "X" corresponds to Table 2.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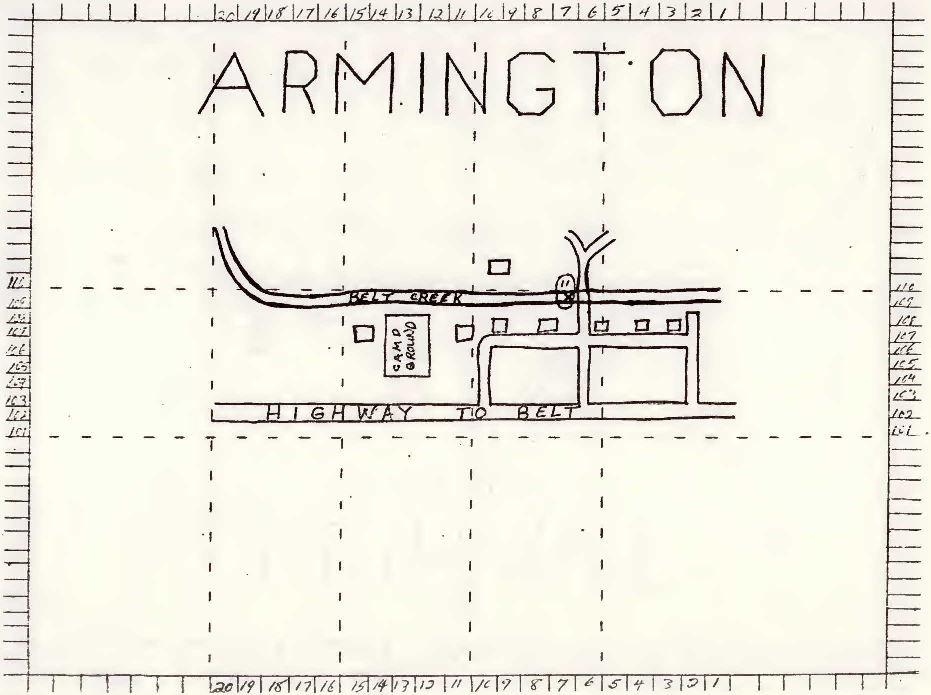
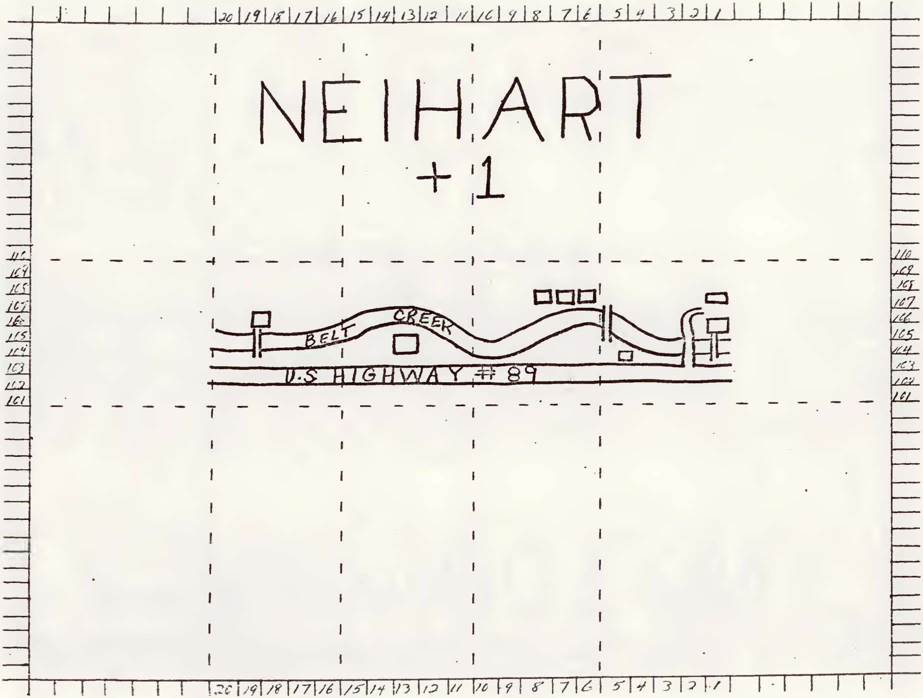
BM 3468
Tracy
Stockett
BM 3871
A-11
Belt
Armington
A-2
13
A-3
JUDITH BASIN COUNTY
Giffen
A-10
Blythe
TO RAYNESFORD GEYSER STANFORD LEWISTOWN
12
Eden
A-9
10
A-1
Goodman
I-2
89
Riceville
JUDITH BASIN COUNTY
Calvert
Evans
A-8
A-4
A-7
Albright
Lick Creek Cave
Logging Creek
Monarch
Hughesville
8309
BARKER MTN
Barker
A-6
A-5
LEWIS AND CLARK NATIONAL FOREST
LEWIS AND CLARK
89
NATIONAL FOREST
COUNTY
MEAGHER COUNTY
Missile Sites
6
NEIHART BALDY EL. 8286
Neihart
BM 5635
5
1
O'BRIEN PARK
PORPHYRY PEAK 8192
Kings Hill

ARMINGTON


BELT CREEK
11
CAMP GROUND
HIGHWAY TO BELT
20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
110 109 108 107 106 105 104 103 102 101


NEIHART
+1
BELT CREEK
U.S HIGHWAY #89
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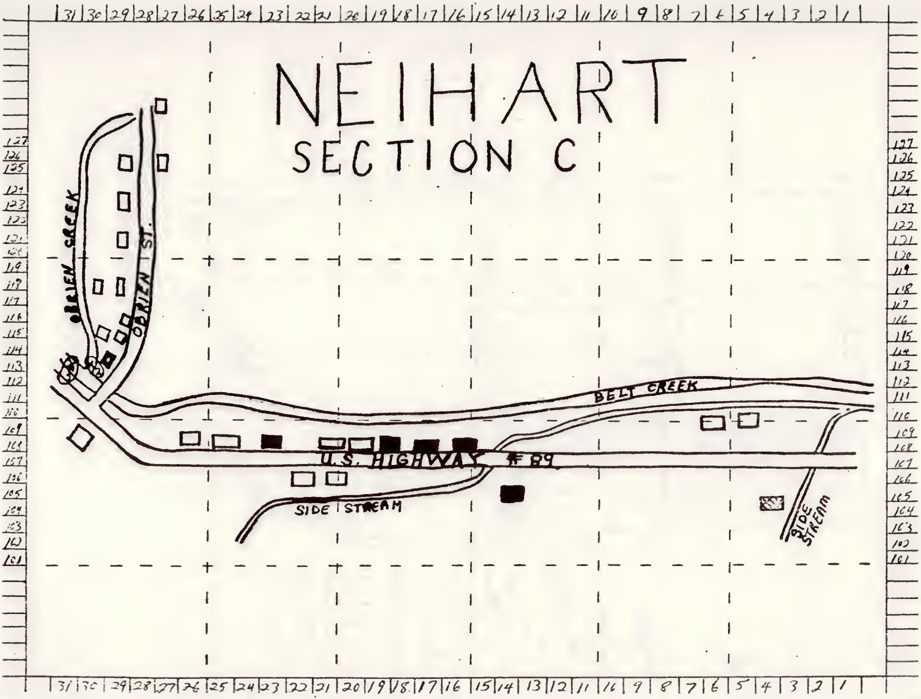
110
109
108
107
106
105
104
103
102
101


NEIHART
SECTION C
OBRIEN CREEK
OBRIEN ST.
BELT CREEK
U.S. HIGHWAY #89
SIDE STREAM
SIDE STREAM
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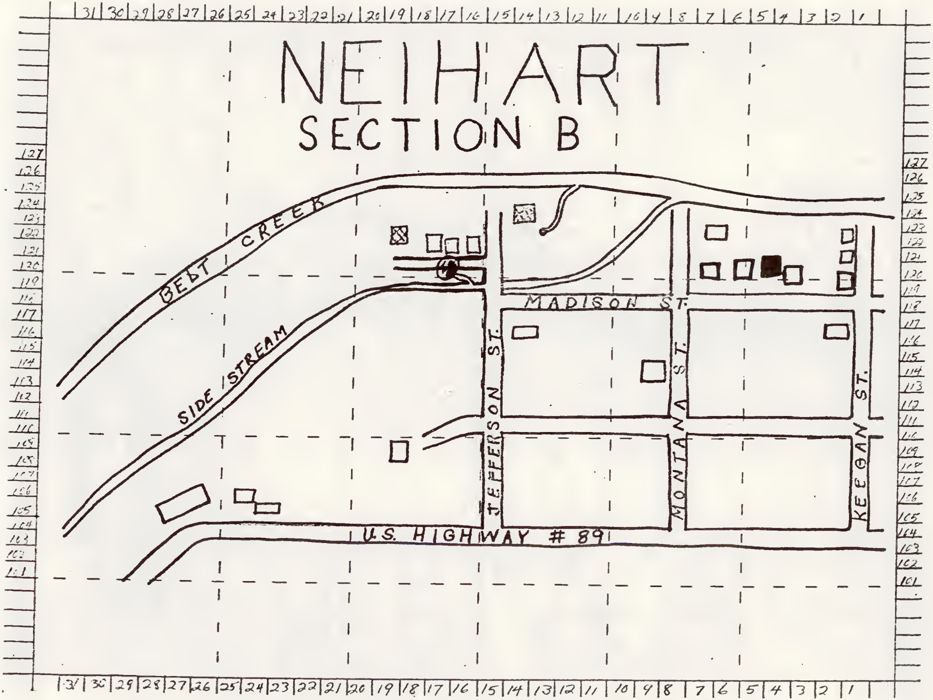


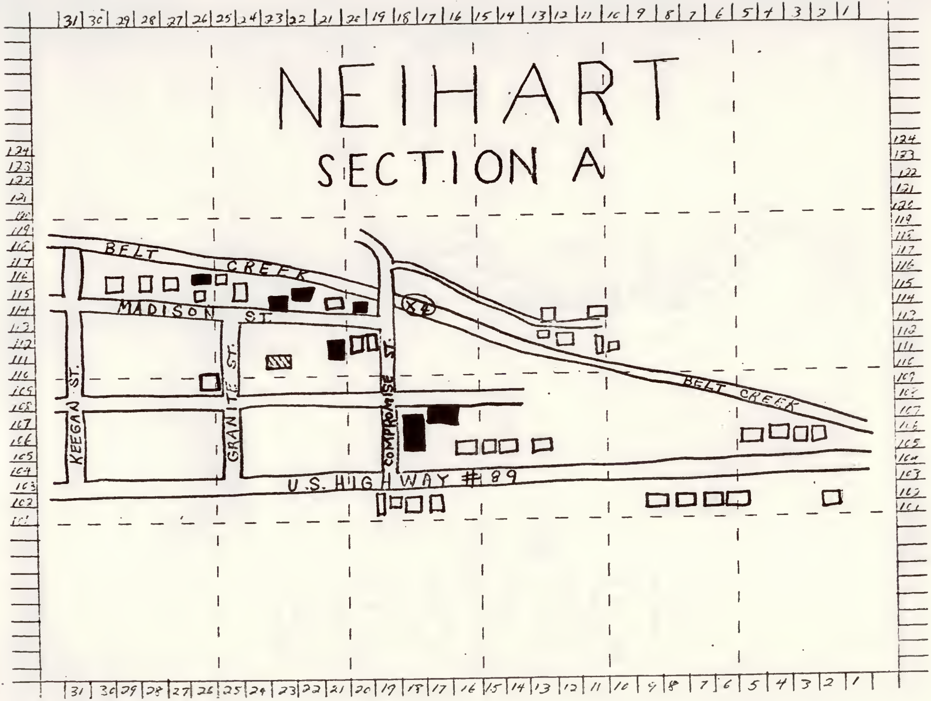
NEIHART

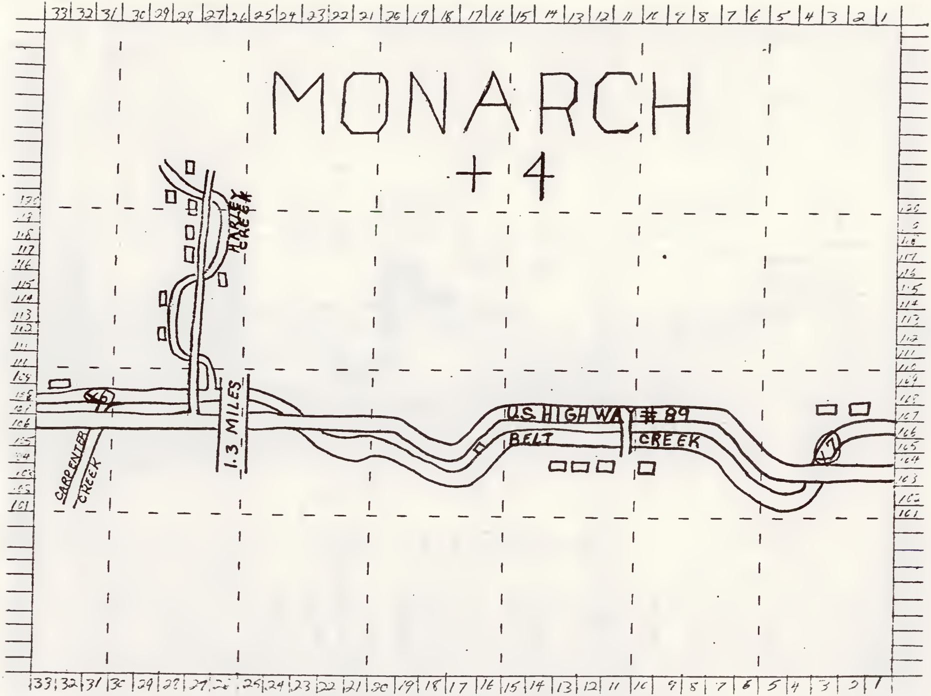
SECTION B

BELT CREEK
SIDE STREAM
MADISON ST.
JEFFERSON ST.
MONTANA ST.
KEEGAN ST.
U.S. HIGHWAY # 89

NEIHART

SECTION A


BELT CREEK
MADISON ST.
X4
KEEGAN ST.
GRANITE ST.
COMPROMISE ST.
BELT CREEK
U.S. HIGHWAY #89


MONARCH
+4
HARLEY CREEK
1.3 MILES
U.S. HIGHWAY # 89
BELT CREEK
CARPENTER CREEK
33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
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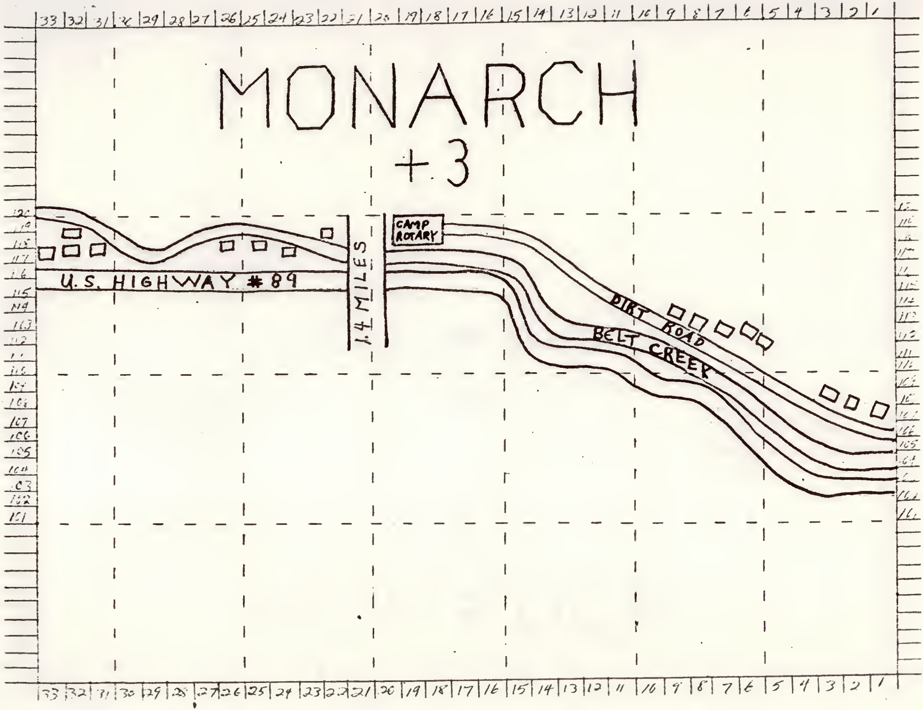
MONARCH
+3



U.S. HIGHWAY #89
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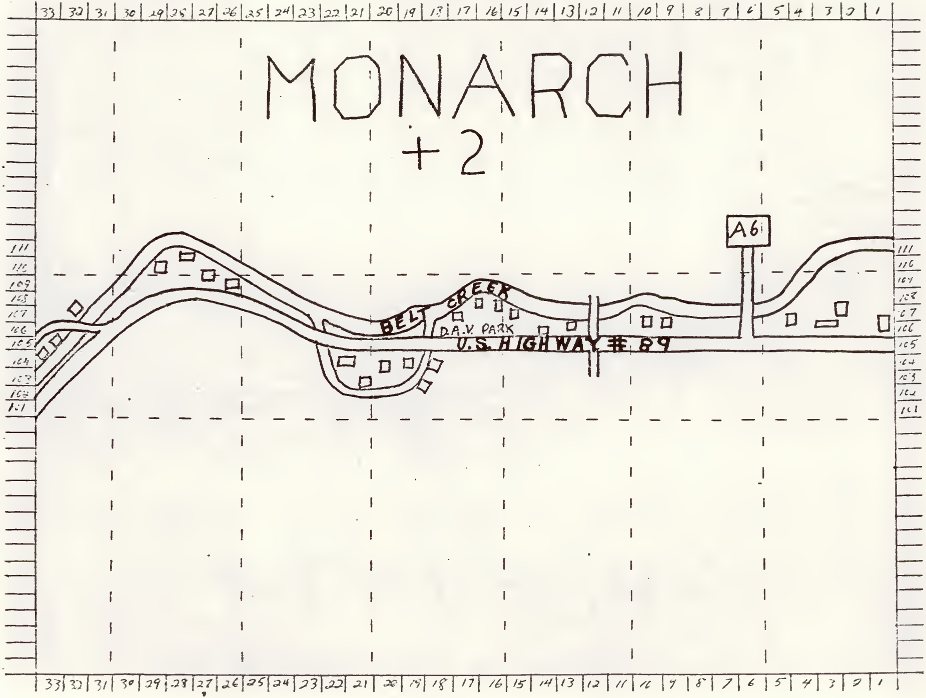
CAMP ROTARY
DIRT ROAD
BELT CREEK


MONARCH
+2
A6i
BELT CREEK
D.A.V. PARK
U.S. HIGHWAY # 89
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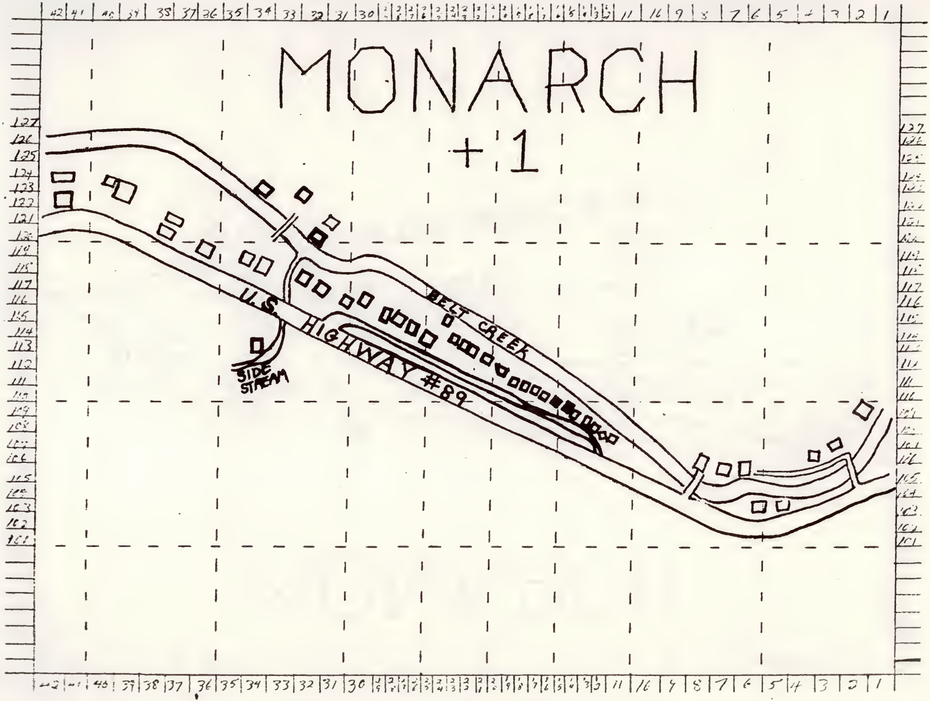
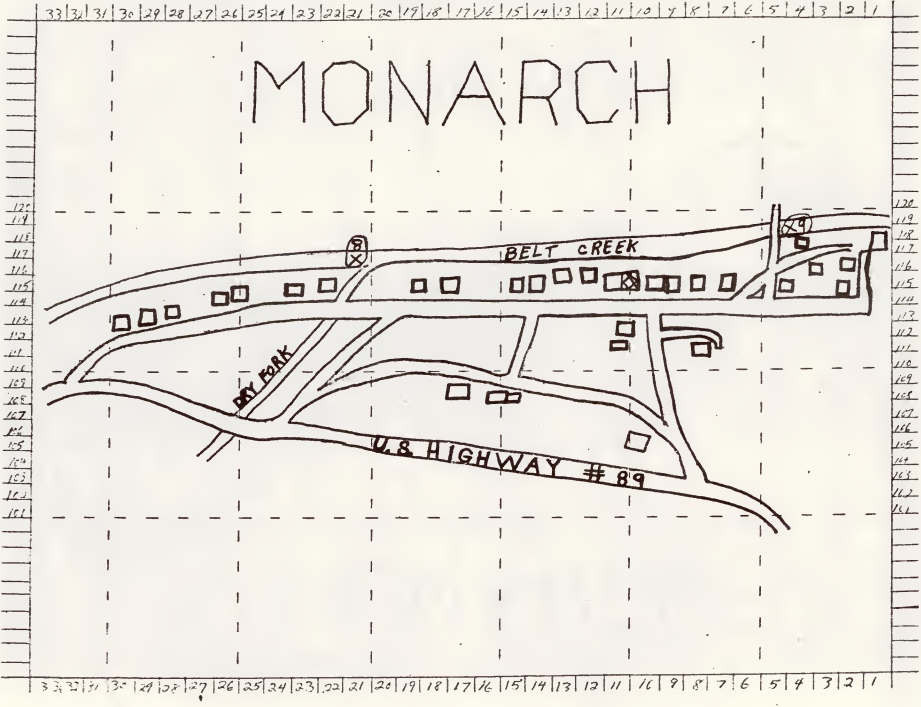
111 110 109 108 107 106 105 104 103 102 101


MONARCH
+1
BELT CREEK
U.S. HIGHWAY #89
SIDE STREAM


MONARCH
BELT CREEK
DRY FORK
U.S. HIGHWAY #89
8
9
33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
120 119 118 117 116 115 114 113 112 111 110 109 108 107 106 105 104 103 102 101

ACKNOWLEDGEMENTS

This work was supported by a grant from the Western Interstate Commission on Higher Education and by an environmental grant from the Jessie Smith Noyes Foundation. The author gratefully acknowledges the help of Robert K. Stevenson for his assistance on this project, and the Montana State University Microbiology Department for the use of their laboratory.

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2. New York State Department of Health. Manual of Instruction for Water Treatment Plant Operators, page 103.

THE RESOURCES DEVELOPMENT INTERNSHIP PROGRAM

The preceding report was completed by a WICHE intern during the summer of 1973 This intern's project was part of the Resources Development Internship Program administered by the Western Interstate Commission for Higher Education (WICHE).

The purpose of the internship program is to bring organizations involved in community and economic development, environmental problems and the humanities together with institutions of higher education and their students in the West for the benefit of all.

For these organizations, the intern program provides the problem-solving talents of student manpower while making the resources of universities and colleges more available. For institutions of higher education, the program provides relevant field education for their students while building their capacity for problem-solving.

WICHE is an organization in the West uniquely suited for sponsoring such a program. It is an interstate agency formed by the thirteen western states for the specific purpose of relating the resources of higher education to the needs of western citizens. WICHE has been concerned with a broad range of community needs in the West for some time, insofar as they bear directly on the well-being of western peoples and the future of higher education in the West. WICHE feels that the internship program is one method for meeting its obligations within the thirteen western states. In its efforts to achieve these objectives, WICHE appreciates having received the generous support and assistance of the Economic Development Administration, the Jessie Smith Noyes Foundation, the National Endowment for the Humanities, the National Science Foundation, and of innumerable local leaders and community organizations, including the agency that sponsored this intern project.

For further information, write Bob Hullinghorst, Director, Resources Development Internship Program, WICHE, Drawer "P", Boulder, Colorado, 80302, (303) 443-6144.

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